# TEST METHOD FOR SOLDERMASK CURE

**DOCUMENT IDENTIFIER:** A-SP-ELMF601-00-0 Rev A, 30-Jun-1989

**ABSTRACT:** This document specifies the test method used to determine the cure of soldermask on a printed-wiring board (PWB) fabricated or purchased by Digital Equipment Corporation.

**APPLICABILITY:** This document applies to all organizations involved in the fabrication of PWBs with soldermask.

**STATUS:** Approved 30-Jun-1989; type $VTX SMC for expiration date.

This document is confidential and proprietary. It is an unpublished work protected under the Federal copyright laws.

© Digital Equipment Corporation. 1989. All rights reserved.

# TEST METHOD FOR SOLDERMASK CURE

DOCUMENT IDENTIFIER: A-SP-ELMF601-00-0 Rev A, 30-Jun-1989

REVISION HISTORY: No previous revision exits.

Document Management Category: Board Manufacture (MB)
Responsible Department: External Board Business
Responsible Person: James B. O'Malley, Jr.
Author: James B. O'Malley, Jr.
Writer: Eleanor Jacobi

APPROVAL: This document has been approved for use throughout Digital.

---

James B. O'Malley, Jr., Corporate Printed-Wiring Board Quality

Direct requests for further information to:

James B. O'Malley, Jr.

LJO1-1/B2, DTN: 226-2043, BOARDS::OMALLEY

Copies of this document can be ordered from:

Standards and Methods Control

$ VTX SMC, JOKUR::SMC, DTN: 287-3724, or NRO4/D4

Please provide your name, mailstop, cost center, badge number, and node address when ordering.

## CONTENTS

1 INTRODUCTION . . . . . 1
1.1 EQUIPMENT AND MATERIALS . . . . . 1
1.2 MESERAN TEST SOLUTIONS . . . . . 1
2 CALIBRATION . . . . . 2
2.1 UNIT CALIBRATION . . . . . 2
2.2 DISPENSER CALIBRATION . . . . . 2
3 OPERATING PROCEDURE . . . . . 3
4 DATA ANALYSIS AND ACCEPTANCE CRITERIA . . . . . 12
5 SYSTEM MAINTENANCE - REFILLING THE TEST SOLUTION VIAL . . . . . 13

## TABLES

1 Soldermasks and Corresponding Test Solutions . . . . . 1

# 1 INTRODUCTION

This document describes the test procedure and the final product acceptance criteria for soldermask over printed-wiring boards (PWBs) fabricated or purchased by Digital Equipment Corporation. It applies to any type of soldermask including dry film, screenable, or photoimageable.

Persons using this document to evaluate the cure of soldermask should have a basic familiarity with laboratory techniques and formal training in the operation of the Meseran Evaporative Rate Analyzer (model 1200).

All internal organizations involved with fabrication and the use of soldermask and all external vendors under contract to produce PWBs with soldermask for Digital must understand and comply with the requirements of this document.

## 1.1 EQUIPMENT AND MATERIALS

The following equipment is needed to perform the test procedure.

- Meseran Evaporative Rate Analyzer (Model 1200))
- Single-depression glass microslide
- Rubber gloves
- File
- Nitrogen gas and pressure regulator
- Meseran test solutions

## 1.2 MESERAN TEST SOLUTIONS

Table 1 identifies the test solution for each soldermask.

**Table 1: Soldermasks and Corresponding Test Solutions**

| Soldermask | Test Solution |
|---|---|
| DuPont's 8000 series dry film mask | AL2X |
| Chemline's PC602 dry film mask | AL2X |
| Ciba-Geigy's Probimer 52 wet photoimageable mask | AL2X |
| Chemline's PC401 wet screenable mask | AH |
| Chemline's PC501 wet screenable mask | AJ05H3X |
| Dynachem's DM dry film mask | AJ05H3X |

The test solution for DuPont's 8000-series dry film mask, Chemline's PC602 dry film mask, and Ciba-Geigy's Probimer 52 wet photoimageable mask is AL2X. This solution contains:

```
 A  = 1,1,2,2-Tetrabromoethane-1,2-C14
 L  = Chloroform
 2X = Double Activity of the radio-labeled solvent
```

The test solution for Chemline's PC401 wet screenable mask is AH. This solution contains:

```
 A  = 1,1,2,2-Tetrabromoethane-1,2-C14
 H  = Methylene Chloride
```

The test solution for Chemline's PC501 wet screenable mask and Dynachem's DM dry film mask is AJ05H3X. This solution contains:

```
 A  = 1,1,2,2-Tetrabromoethane-1,2-C14
 J  = 1,1,2-Trifluorotrichloroethane
05  = 5%
 H  = Methylene Chloride
3X  = Triple Activity of the radio-labeled solvent
```

## 2 CALIBRATION

At the start of each shift, the operator must perform the calibrations described in subheads 2.1 and 2.2.

### 2.1 UNIT CALIBRATION

Use the following procedure to perform the unit calibration.

1. Return to the Main Menu of the Meseran program.
2. Select #1, NEW TEST.
3. Set the operating conditions to 1, 2, 3, 4A, 5, 6, 7, 8A, 9.

**NOTE**

**Selection 3 checks background radiation, 4 checks the operation of the dispenser, 5 checks line voltage, and 6 checks temperature and gas flow.**

### 2.2 DISPENSER CALIBRATION

Use the following procedure to perform the dispenser calibration. Record the results checking that they are consistent with previous results.

1. Place the single-depression glass microslide under the dispenser's syringe.
2. Evaluate the drop size.
3. Measure the radioactive energy emitted.

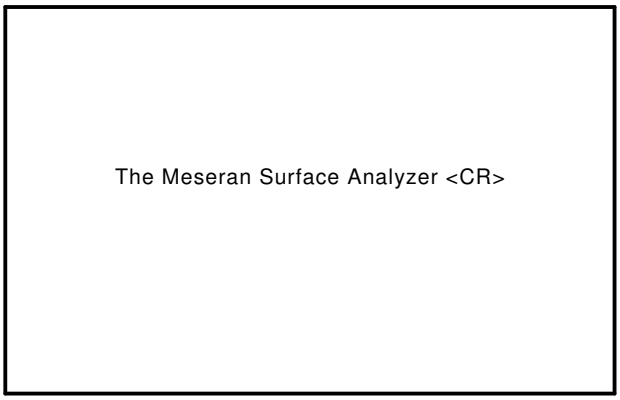
Repeat steps 1, 2, and 3 five times. The standard deviation of the five tests should be less than five percent.

## 3 OPERATING PROCEDURE

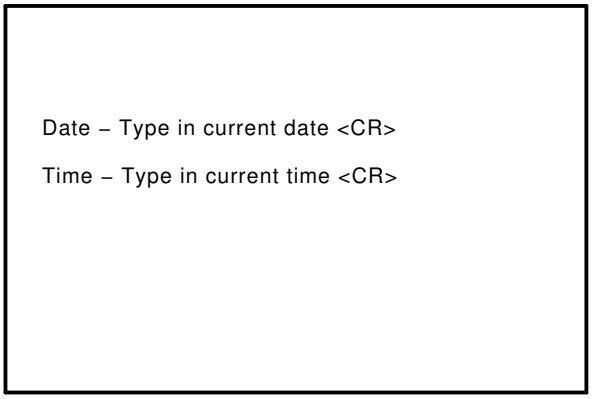
Use the following procedure to operate the Meseran Evaporative Rate Analyzer.

1. Turn on the nitrogen gas service. There are two gauges on the regulator: the gauge on the right of the regulator measures the pressure in pounds per square inch (psi) of nitrogen in the cylinder, the gauge on the left of the regulator indicates the pressure of the gas going to the unit. If the second gauge does not show any pressure, turn the t-screw until the pressure reads 50-60 psi.
2. Turn on the power for the Meseran unit at the remote control box.
3. Turn on the power for the computer using the switch at the rear lower right side of the unit.
4. Turn on the display terminal using the power switch on the front of the unit.
5. Load the Meseran program "MSC2", by simultaneously pressing the CONTROL, ALTERNATE, and DELETE keys. If the A> prompt appears, type "MSC2". At the completion of each screen press <CR> to display the next screen.

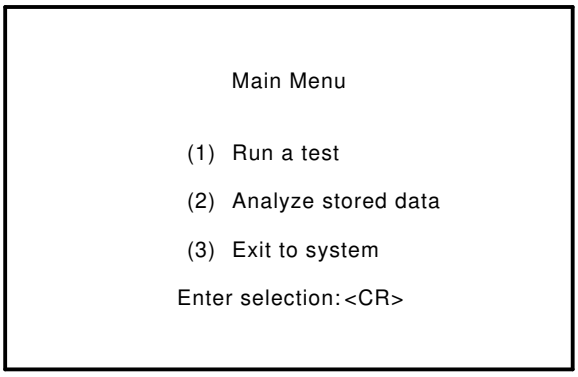
### Screen 1




### Screen 2

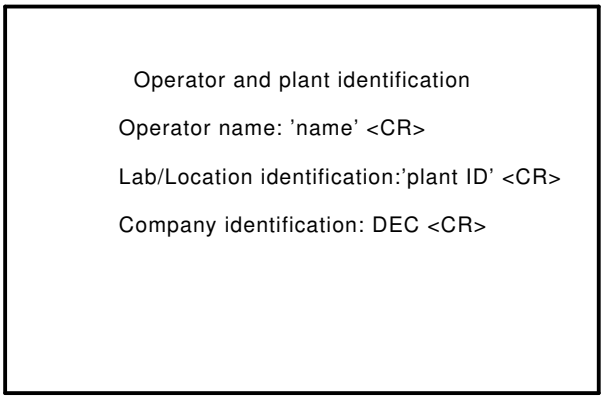


### Screen 3



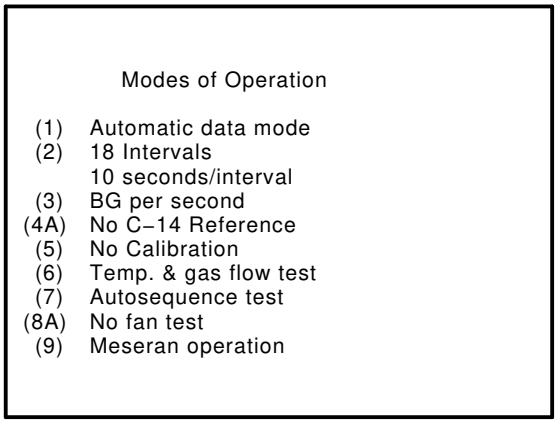

Select 1 to run a test. Select 2 to analyze data that was run previously and is stored on a hard or floppy disk. Select 3 to return to the MS/DOS prompt A>.

### Screen 4




- At the "operator name" prompt, enter the operator's last name.
- At the "lab/location identification" prompt, enter the three letter site code, for example, "GSO."
- At the "company identification" prompt, type "DEC".

## Screen 5

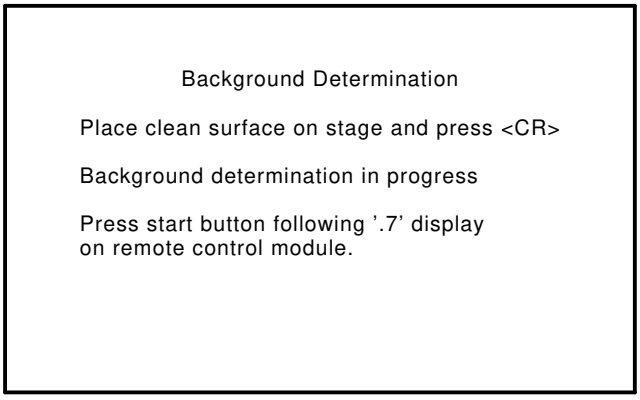



At Screen 5, the operator selects the following conditions for the Meseran unit.

1. Selection 1 allows the operator to choose automatic or manual mode. In automatic mode the computer makes all the necessary equipment movements; in manual mode the operator must make all the equipment movements. The operator should select automatic mode to ensure consistent test results.
2. Selection 2 allows the operator to choose the data report format. It is recommended to leave this set at 18 intervals, 10 seconds/interval.
3. Selection 3 refers to background determination. This option provides the operator and the computer with the level of background radiation present during the test. Leave this option on; the computer needs the information to correctly adjust the calculation for excess radiation present during the test.
4. Selection 4 allows the operator to test the proper functionality of the Geiger-Muller (G-M) tube. Select "ON" to conduct the test; otherwise select "OFF"'.
5. Selection 5 performs an internal check of the line voltage supplied to the unit by measuring the number of cycles in thirty seconds. With 110V power, the unit should cycle 60 times per second; in thirty seconds the unit should cycle 1800 times if the power supply remains stable. If, after performing this test, the power supply is found to be unstable a power conditioner should be installed on the unit.
6. Selection 6 provides the temperature within the unit and the average gas flow across the G-M tube surface.
7. Selection 7 allows the operator to check the operation of the test solution dispenser before depositing test solution on a board.
8. Selection 8A allows the operator to test the functionality of the fan at the back of the unit. This fan is necessary to vent the fumes generated in the hood during a test run.
9. Selection 9 is not functional.

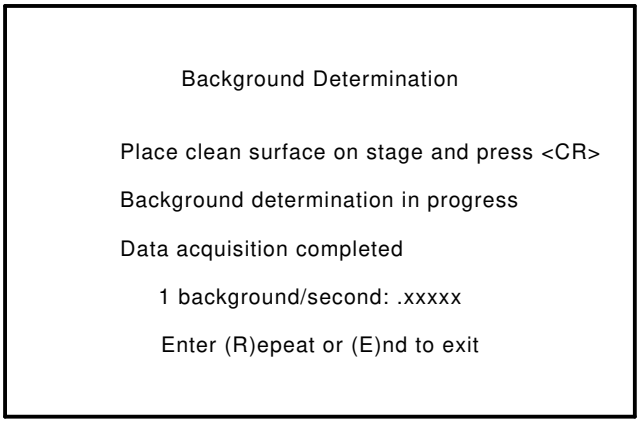
To select a routine enter the corresponding number; for example, to test the solution dispenser enter "7". Type "R" to return to the main menu; otherwise type "Y".

### Screen 6


Background Determination
Place clean surface on stage and press <CR>
Background determination in progress
Press start button following '.7' display
on remote control module.

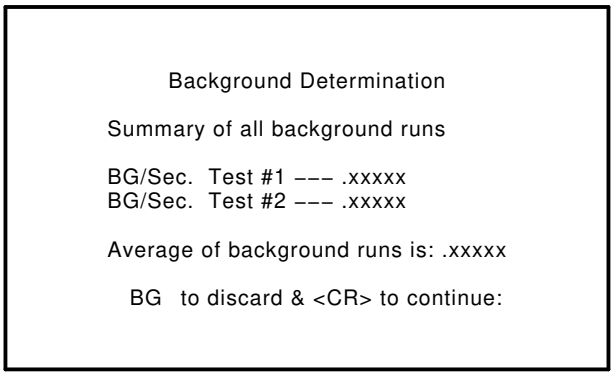
Screen 6 displays before and during the FIRST background determination. Place the board to be tested under the G-M tube. When the operator presses <CR> the system begins calculating the amount of background radiation present in the unit.

### Screen 7


Background Determination
Place clean surface on stage and press <CR>
Background determination in progress
Data acquisition completed
1 background/second: .xxxxx
Enter (R)epeat or (E)nd to exit

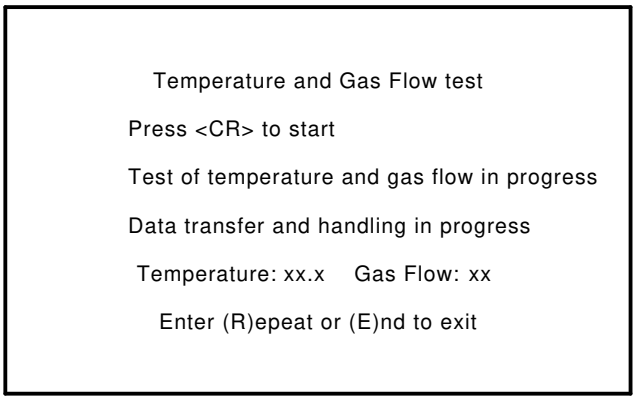
Screen 7 displays AFTER the first background determination. Enter "R" to perform the second test. The operator must perform two initial background tests to determine whether the equipment is functioning properly. The results of both background tests should be either very similar or identical. Screen 7 continues to display as long as the operator selects "R". Select "E" to display the next screen.

### Screen 8


Background Determination
Summary of all background runs
BG/Sec. Test #1 --- .xxxxx
BG/Sec. Test #2 --- .xxxxx
Average of background runs is: .xxxxx
BG to discard & <CR> to continue:

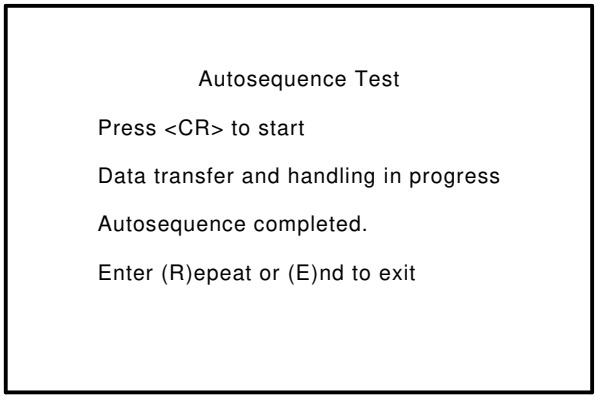
The system automatically calculates and displays the average for all runs performed. At Screen 8 the operator may choose to delete a specific background run by entering the test number and pressing <CR>. To accept the average that is displayed, press <CR> only.

### Screen 9


Temperature and Gas Flow test
Press <CR> to start
Test of temperature and gas flow in progress
Data transfer and handling in progress
Temperature: xx.x Gas Flow: xx
Enter (R)epeat or (E)nd to exit

The operator must perform this section of the start-up procedure. At Screen 9 the operator sets the gas flow. The gas flow must be kept constant to determine the level of cure for the soldermask. If the gas flow fluctuates, daily test results cannot be compared. The gas flow must be set and maintained at approximately 50.

### Screen 10




During the autosequence test the dispenser deposits a small quantity of test solution to check the operation of the dispenser. The operator must remove any actual test boards and place a paper towel under the end of the syringe to avoid depositing test solution on the test stage.

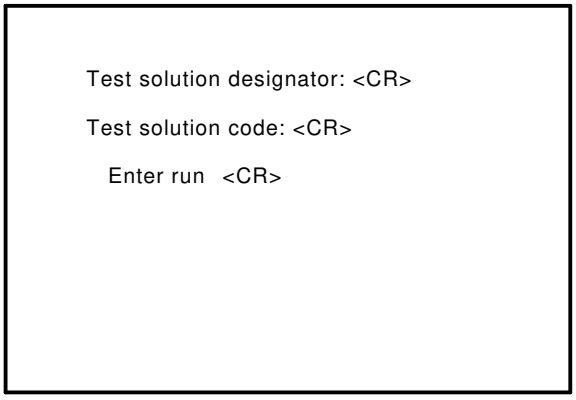
When the autosequence test is completed, the operator positions the actual test board using the following procedure.

1. Place the actual test board under the dispenser.
2. Place the spacing disc on top of the printed-wiring board, adjusting the height of the G-M tube until the disc slides freely. This is the "standard" height.
3. The G-M tube must be set at the standard height for each test to ensure consistent test results.
4. Position the test board at an adequate test site. An adequate test site is an area that is free of fingerprints and away from a plated-through hole (PTH) or a via hole.

**NOTE**

**When any solution enters a hole the test results are inconsistent.**

### Screen 11

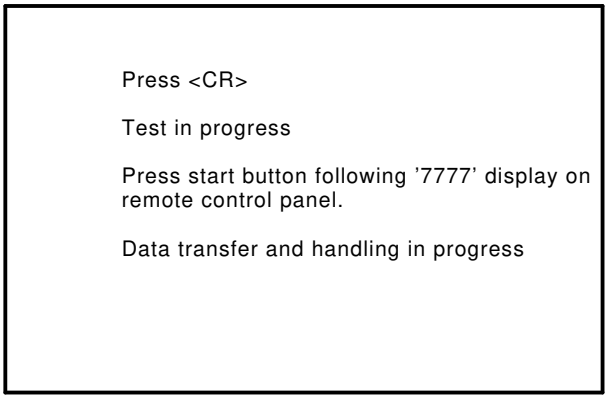



At Screen 11, the test solution designator is found on the test vial label. It is the test solution specified for the type of soldermask being tested. The operator must enter this information into the system to allow tracking of boards that were tested with a specific vial of test solution.

The test solution code is also found on the test vial label. The test solution code allows Digital to guarantee that the soldermask was tested with the proper solution and that test results are valid.

The run number is the lot number of the boards being tested.

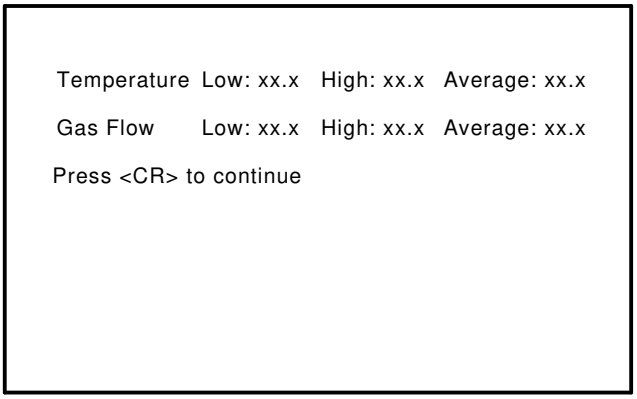
### Screen 12


Press <CR>
Test in progress
Press start button following '7777' display on remote control panel.
Data transfer and handling in progress

Screen 12 begins the 180 second test. The board being tested is properly located at the end of Screen 10. Press <CR> to begin the test. The operator must press the start button on the remote control panel after "7777" displays. This starts the three minute test of the soldermask cure.

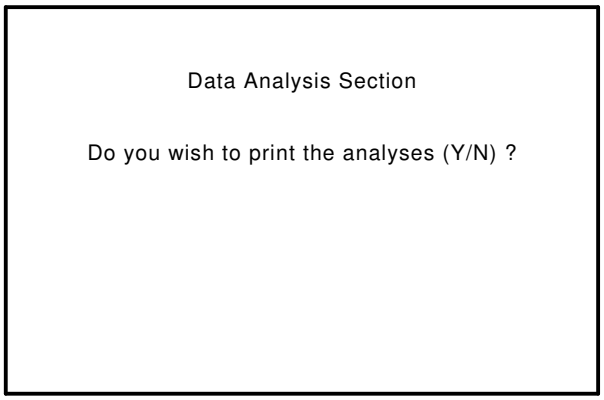
At the end of the three minute test the system displays the message "Data transfer and handling in progress." At this time the system is unable to perform any other tasks; it is transferring the acquired data from the Meseran unit computer to the Mesaran MS/DOS computer. When the transfer is completed, Screen 13 displays.

### Screen 13



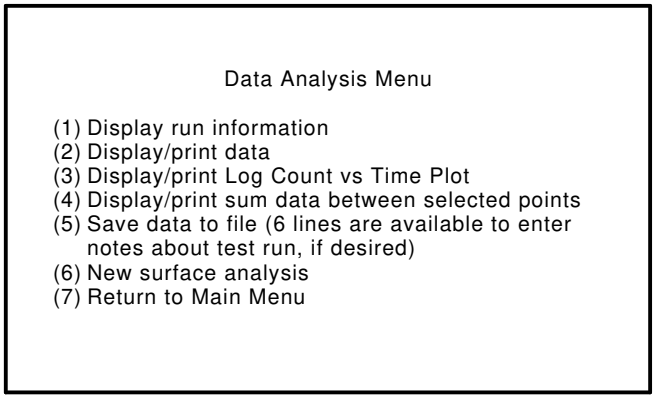

Screen 13 is for informational purposes. The operator must check the gas flow to be certain it is still at 50. If the gas flow is fluctuating, it must be readjusted.

### Screen 14




The operator must enter "Y" or "N," then press <CR> to display the next screen.

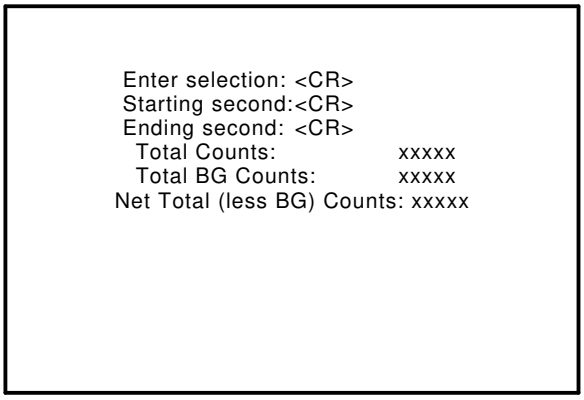
### Screen 15


Data Analysis Menu
(1) Display run information
(2) Display/print data
(3) Display/print Log Count vs Time Plot
(4) Display/print sum data between selected points
(5) Save data to file (6 lines are available to enter notes about test run, if desired)
(6) New surface analysis
(7) Return to Main Menu

Screen 15 is the Data Analysis Menu. Use the following procedure.

1. Enter "5".
2. Press <CR>.
3. Enter "S" to save the data to a floppy disk or the hard disk.
4. The operator may enter comments about the test run or the materials.
5. When comments have been completed, press <CR> twice to return to Screen 15.
6. If no comments are entered, press <CR> once to continue.

### Screen 16

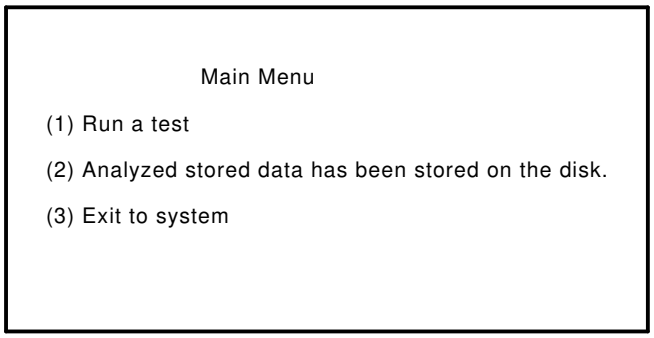



At Screen 16 use the following procedure.

1. At "Enter selection" enter "4".
2. At "Starting second" enter "1".
3. At "Ending second" enter "180".

4. The system automatically calculates and displays the total counts, total BG counts, and the net total counts.
5. Press <CR> to continue; the system displays the Data Analysis Menu.
6. Select "7" to return to the main menu.

### Screen 17




At Screen 17 the operator has the following three options.

1. Selection 1 begins a new test.
2. Selection 2 displays a directory of data stored on the disk.
3. Selection 3 exits the system.

## 4 DATA ANALYSIS AND ACCEPTANCE CRITERIA

All types of soldermask to be tested need to be compared against a standard calibration curve. The following procedure is used to determine this curve.

- Select the number of boards to be cured.
- Cure the first board.
- Record the Meseran count.
- Increment the cure condition.
- Record the Meseran count.
- Plot the counts versus joules per $cm^2$.
- Identify the count for the manufacturer's recommended cure range.
- All boards with the manufacturer's cure should fall within the count range. This range becomes the standard calibration curve.

Digital's GSO facility, for example, established their standard calibration curve by testing dry film mask cured in a range from 1.0 Joule/cm² to 10.0 Joules/cm², in one joule increments. GSO's acceptance criteria for DuPont's dry film soldermask is any mask that produces between 5,000 and 15,000 total Meseran counts when tested with the Meseran Evaporative Rate Analyzer, Model 1200.

## 5 SYSTEM MAINTENANCE - REFILLING THE TEST SOLUTION VIAL

Have the following supplies easily accessible before starting the refilling procedure.

- Ampule of test solution
- File to score glass
- Rubber gloves
- Safety glasses
- Moistened paper towel
- A test solution bottle

Use the following procedure to refill the test solution vial. Perform this procedure in a fume hood.

1. Score the test solution ampule on both ends with the file.
2. Snap off one of the ends by placing it in the moistened paper towel; this reduces the number of glass shards generated when breaking the glass.
3. Place the open end into the test solution bottle.
4. Snap off the second end of the ampule following the same procedure. The test solution empties into the test solution bottle.

At this point, perform a visual inspection of the test solution bottle to check for pieces of glass in the bottle. If there is glass in the bottle the solution should be transferred to another clean bottle.

**NOTE**

**If glass is introduced into the dispenser, the inside of the dispenser will be damaged and the test results will be invalid (see Dispenser Calibration). Damage occurs when the glass cuts the Teflon sleeve inside the dispenser used as the test sample reservoir (20 microliters). A cut in the sleeve increases the volume of the dispenser and more test solution will be dispensed, resulting in a higher number of total counts.**

```
+---------------------------------------------------------------------+
|                        READER COMMENTS                              |
|                                                                     |
| Your  comments  and suggestions  will help  Standards and Methods   |
| Control improve their services and documents.                       |
+---------------------------------------------------------------------+
```

Did you request this document? _____ If so, did it arrive within a satisfactory period of time? _____ Please comment.

What are your impressions of this document? Consider format, organization, completeness, readability, and illustrations.

**_____ FOLD ON THIS LINE_____**

Did you find technical or clerical errors in this document? If so, please specify the page number(s) and the error(s).

Are the instructions for the update package clear? _____
Was an index available? _____ If not, is one needed? _____
Do you have other suggestions for improving this document?

The following information is optional:

Name _____ Mailstop _____

Department _____ Node _____

Send your comments to JOKUR::PROJECTS, or fold, staple, and send this page through interoffice mail to:

```
+------------------------------+
|       READERS' COMMENTS      |
| STANDARDS AND METHODS CONTROL |
|          NRO4/D4             |
+------------------------------+
```